RESPONSE OF TROPICAL CORN TO NITROGEN AND STARTER FERTILIZER IN CONVENTIONAL AND STRIP TILLAGE SYSTEMS

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INTRODUCTION

Tropical corn *(Zea mays* L.) has become an important alternative crop in the southeastern United States in the past few years. It has been estimated that over 50,000 acres was grown in 1991, mostly for silage (Wright et al., 1991). Due to its late optimum planting date, tropical corn serves as an alternative crop to soybeans *(Glycine max* L.), grain sorghum (Sorghum bicolor L.), and temperate corn (Wright et al., 1990a and b; Teare, et al., 1991). Obtaining a late-season grain or silage crop, in addition to high silage yields, makes tropical corn an attractive alternative crop for the South.

Double-cropping tropical corn with wheat *(Triticum aestivum* L.) using reduced tillage would be a desirable system. However, very little data have been reported regarding the nitrogen (N) requirements of tropical corn when grown as a double-crop, under no-till, or conventional-tillage systems (Reeves et al., 1991). There is also a need to assess starter fertilizer needs for tropical corn when grown as a double-crop, under no-till, and conventional-tillage systems.

MATERIAL AND METHODS

To determine optimum management practices for tropical corn in south Alabama, a 3-year field study was initiated in 1990 at the Wiregrass Substation in Headland, Alabama, on a Dothan sandy loam soil (Plinthic Paleudult). Tropical corn hybrid Pioneer 304C was planted on 1 June 1990, and tropical corn hybrid Pioneer 3072 was planted on 4 June and 13 June in 1991 and 1992, respectively. Tillage treatments consisted of strip and conventional tillage. The five starter fertilizer treatments were: (1) no starter, (2) 20 lb N/A, (3) 20 lb P/A, (4) 20 lb N and 20 lb P/A, and (5) 20 lb N, 20 lb P, and 10 lb S/A. Nitrogen treatments consisted of 0, 50, 100, and 150 lb/A. The experiment was a split-split plot design with the two tillage systems as whole plots, starter fertilizer treatments as split plots, and N rate as split-split plots.

Wheat was planted each fall. After the wheat matured in late spring, the test area was prepared according to the tillage system. Conventional tillage consisted of chisel plowing and disking followed by in-row subsoiling at planting. Strip tillage consisted of in-row subsoiling and planting into wheat stubble. The starter treatments were applied at planting as a solution in an approximate 2 x 2-inch placement. Nitrogen as ammonium nitrate was applied as a sidedress approximately 4 weeks after planting. Each plot was 30 ft in length and consisted of 8 rows with a 36-inch spacing. Plant population for all 3 years of the study was approximately 20,000 plants/A.

Grain yields were not determined in 1990 due to severe insect pressure, but grain yields were determined in 1991 and 1992. Grain was harvested from the two middle rows of all plots on 10 October and 14 October 1991 and 1992, respectively. Grain moisture was determined on a minimum of 20 plots and averaged over the test.

Silage yields were determined by cutting a total of 10 ft of row per plot. Silage was harvested on 28 August, 5 September, and 9 September in 1990, 1991, and 1992, respectively. The whole plants were weighed and subsamples collected to determine dry matter content. Subsamples were dried at 60°C and weighed.

In 1991 and 1992, subsamples of silage were analyzed for forage quality. The silage was analyzed for crude protein, acid detergent fiber, and neutral detergent fiber.

Using SAS procedures (SAS Institute, 1985), yield and forage quality were statistically analyzed. Means were separated with Fisher's Protected LSD.

RESULTS AND DISCUSSION

In 1990, there were no interactions between tillage, starter fertilizer, or N. Excellent silage yields were obtained with the conventional and strip tillage systems, averaging 17.1 and 203 t/A, respectively. The addition of N increased yields, but a significant response was only obtained up to the 50 lb N/A rate (data not shown). This response was most likely due

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to the variety grown in 1990 (Pioneer 304C), as well as drought conditions and severe infestation of fall armyworm *(Spodoptera frugiperda).* Starter fertilizer also increased yields (Table l), with the NP treatment increasing silage yields by 3.1 t/A.

In 1991, silage and grain yields increased with N rate (Table 2), with consistently higher yields occurring under strip tillage. The best starter treatment for silage was the NP treatment under the strip-tillage system (Table 1). For grain, N alone as a starter was adequate, averaging 63 bu/A over tillage systems (data not shown).

In 1992, grain and silage yields were much lower, and the two tillage systems produced similar yields (Table 2). Grain yields in 1992 ranged from 23 to 45 bu/A and increased with increasing rates of N (Table 2). The best starter for grain was the NP treatment (data not shown). Low grain yields were the result of low rainfall distribution. This is in contrast to results obtained at two other locations in Alabama in 1992. Grain yields at these locations averaged above 100 bu/A when using the same variety and similar planting dates.

Forage quality of the harvested silage was affected primarily by the rate of N (Table 3). As expected, crude protein increased with increasing N rate. Both ADF and NDF decreased with increasing N rate.

CONCLUSIONS

Strip tillage gave higher silage yields in 2 out of 3 years and higher grain yields in **1** year when compared with conventional tillage. Higher silage yields were obtained with the NP starter when averaged over both tillage systems in 2 out of 3 years. For grain, N alone as a starter fertilizer gave the best results under strip tillage, whereas NP was the best starter under conventional tillage. In 1990, due to variety (Pioneer 304C), drought, and insect pressures, silage yields did not increase above 50 lb N/A. In 1991 and 1992, Pioneer 3072 was grown and rainfall was adequate. An increase in silage yields was obtained up to the 150 lb/A N rate.

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Table 1. Tropical corn silage yields in 1990 and 1991 averaged over N rates as affected by starter fertilizer treatments.

Starter Fertilizer[&]	1990[#]	1991 Conv.	1991 Strip
	tons/A		
None	16.9	9.5	9.7
N	18.7	8.9	11.0
P	173	9.8	10.0
NP	20.0	10.6	**113**
NPS	20.6	**9.2**	10.7
$LSD_{0.10}$	2.1	1.0[t]	

[&] 20 lb N/A, 20 lb P/A, 10 lb S/A; [#] Averaged over tillage treatments;
[t] Tillage by starter interaction LSD.

Table 2. Tropical corn silage yields in 1990, silage and grain yields in 1991, and grain yields in 1992 (averaged) over starter treatments) as affected by the rate of N fertilizer.

N rate	1990 Silage	1991 Silage Conv.	1991 Silage Strip	1991 Grain Conv.	1991 Grain Strip	1992 Grain Conv.	1992 Grain Strip
lb/A	tons/A			bu/A			
0	163	6.9	63	26	29	29	23
50	17.8	9.0	10.7	46	62	36	34
100	183	10.9	12.0	56	74	42	45
150	17.9	11.6	133	60	81	45	39
$LSD_{0.05}$	**2.0**	NS'		**5**		4.8	
$LSD_{0.10}$	---	**1.2**		---		---	

[&] Tillage by N rate interaction LSD.

Table 3. Tropical corn forage quality in 1991 and 1992 as affected by the rate of N fertilizer.

Nitrogen rate	Crude Protein 1991	Crude Protein 1992	NDF 1991	NDF 1992	ADF 1991	ADF 1992
	%					
0	4.6	4.8	59	62	33	36
50	4.9	53	56	59	30	33
100	5.7	6.0	54	57	28	32
150	63	6.5	**53**	57	27	**31**
$LSD_{0.05}$	0.8	**1.0**	1.2	1.0	0.97	1.4